

**APPLICATION FOR UNITED STATES LETTERS PATENT**

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**TITLE:** CAS DATA PROCESSING APPARATUS OF STM-1 INTERFACE  
BLOCK

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# CAS DATA PROCESSING APPARATUS OF STM-1 INTERFACE BLOCK

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

The present invention relates to an Synchronous Transport Module Level 1 (STM-1) interface block, and in particular to a Channel Associated Signaling (CAS) data processing apparatus capable of effectively processing CAS signaling data.

### 2. Background of the Related Art

Generally, a base-to-base interface of an exchanger for processing voices is performed through a 2.048Mbps T1/E1 link. However, because many cables are required to connect a plurality of the T1/E1 link to the opposite exchanger, a T1/E1 signal is typically multiplexed/demultiplexed into T3/STM-1 signal through transmission equipment. The multiplexed signal is then transmitted/received .

Figure 1 is a block diagram illustrating a first related out connection construction between exchangers. Exchangers 10, 13 are separately connected to MUX/DEMUXs 11, 12 through 63 E1 links. The MUX/DEMUXs 11,12 are connected to each other through an STM-1 link. The 63 E1 signals outputted from the exchanger 10 are thus multiplexed into an STM-1 signal in the MUX/DEMUX 11 and then transmitted to the STM-1 link. The MUX/DEMUX 12 demultiplexes the transmitted STM-1 signal into the original 63

E1 signals and outputs them to the exchanger 13. Accordingly, E1 base communication between exchangers 10,13 can be performed.

The exchangers 10, 13 each include 16 E1 interface cards (not shown). Each E1 interface card processes a signal with respect to 4 E1 links. When the E1 interface cards are operated in as a CAS (Channel Associated Signaling) mode, they provide a CAS signaling data (hereinafter referred to signaling data) processing for each channel (time slot), an alarm function for the links, and various test functions. CAS is the transmission of signaling information within the channel.

Figure 2 is a block diagram illustrating the conventional E1 interface card of the exchangers 10, 13 of Figure 1.

Framers 100-1 ~ 100-4 receive a signaling data stream from 4 E1 links, respectively, and local memory (LM) 101 temporarily stores the signaling data outputted from the framers 100-1 ~ 100-4 through a CPU 102. The CPU 102 performs general control operations of the E1 interface card. The CPU 102 also reads the signaling data stored in the LM 101 and reformats it into a report data. A common memory (CM) 103 stores the report data temporarily, and interfaces the E1 interface card with a upper processor 104.

In operation, the framers 100-1 ~ 100-4 perform interface operations with respect to the 4 E1 links respectively, and read the signaling data stream from the corresponding link. The data stream is then stored in its register. Once the signaling data streams are stored, the CPU 102 outputs control signals to the framers 100-1 ~ 100-4 and reads the

signaling data streams from the register of the each framers 100-1 ~ 100-4. Accordingly, as depicted in Figure 3A, for one link, the signaling data streams about 32 channels (time slot) are read from the register, and are stored in the LM 101. The above operations for the other E1 links.

5 When the signaling data streams storing is completed, the CPU 102 reads the signaling data streams stored in the LM 101, reformats it into the report data depicted in Figure 3B, and stores it on the CM 103. The above operation is performed in 8msec real time cycle, the processing for the signaling data stream of the 4 links has to be completed in 8msec. Accordingly, the upper processor 104 performs the control operation for the STM-1 interface block by accessing the report data stored in the CM 103.

10 However, in the first related art connecting construction of the exchanger, because the E1 links have to be extended to a multiplexer 11 and demultiplexer 12, it causes expense increase and maintenance/repair difficulties. Accordingly, in order to solve above-mentioned problems and to process the E1 link more efficiently, a second connecting construction of the exchanger, as depicted in Figure 4, is generally used.

15 As depicted in Figure 4, in the second related art connection construction of the exchanger, the MUX/DEMUX included in transmission section of the first connecting construction are integrated with the exchangers 20, 21. That is, the exchanger 20, 21 include a STM-1 interface block 30 for a physical interface. The STM-1 block 30 includes

a STM-1 link interface 30-1, a synchronous digital hierarchy (SDH) 30-2 and an E1 processing unit 30-3.

The STM-1 link interface 30-1 transmits and receives STM-1 signals and the SDH 30-2 constructs the STM-1 signal by multiplexing/demultiplexing the E1 signal in accordance with an ITU-T (International Telecommunication Union-Telecommunication) recommendation. The E1 processing unit 30-3 processes the E1 links in the same way as the first related art E1 interface card (Figure 2). The E1 processing unit comprises 3 E1 interface cards, each of which processes 21 E1 links respectively.

Accordingly, the E1 processing unit 30-3 of the STM-1 interface block 30 performs various functions such as signaling signal processing, alarming, and error processing. Here, the operations, except for the test function, should be processed in real time by the E1 processing unit 30-3. The above functions thus have to be performed in an 8msec cycle in accordance with a system (upper processor) request.

The conventional E1 interface card adapted to the first connecting construction of the exchanger has various problems. For example, it only performs the processing with respect to the 4 E1 links. Accordingly, if the number of E1 links to be processed is increased, the number of the E1 interface cards and CPUs also have to be increased. This results in complex circuit construction and other difficulties. For example, to process 63 E1 signals, 16 E1 interface cards and 16 CPUs for the 16 E1 interface cards are required.

In addition, the conventional E1 interface card can be used only when the number of E1 links is low. In other words, the load of the CPU needs to be small. Accordingly, if 21 E1 links are present for processing in the STM-1 interface block of the second connecting construction, the related art E1 interface card cannot be used as it is. In other words, when the number E1 links increases, the signaling data processing time is increased in proportion to the number of links. Consequently, the related E1 interface card having the limited CPU processing speed cannot process the signaling data in the required 8msec.

Also, to solve above-mentioned problem, the high speed CPU may be used, but it is not economical due to its expensive price.

The above references are incorporated by reference herein where appropriate for appropriate teachings of additional or alternative details, features and/or technical background.

#### SUMMARY OF THE INVENTION

An object of the invention is to solve at least the above problems and/or disadvantages and to provide at least the advantages described hereinafter.

It is an object of the present invention to provide a CAS data processing apparatus of an STM-1 interface block that substantially obviates the disadvantages caused by problems in the related art. It is another object of the present invention to

provide a CAS data processing apparatus of an STM-1 interface block that is capable of processing CAS signaling data in real time through hardware logic.

It is another object of the present invention to provide a CAS data processing apparatus of STM-1 interface block which can be implemented by a low price CPU by  
5 reducing a load of a CPU in processing the CAS signaling data.

To achieve at least these objects in whole or in parts, there is provided a CAS data processing unit of a STM-1 interface, comprising a plurality of framers for abstracting signaling data streams from a plurality of E1 links, a CPU for outputting a start signal in the CAS signaling data processing, a CAS signaling processing unit for reformatting the signaling data streams outputted from the plurality of the framers into a report data, and a common memory for storing the report data outputted from the CAS signaling processing unit.  
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To further achieve at least these objects in whole or in parts, there is provided a channel associated signaling (CAS) data processing apparatus of a STM-1 interface block, comprising a plurality of framers, coupled to extract signaling data streams from a plurality of E1 links; a CPU, configured to output a start signal to control signaling data processing; a signaling processing unit, which is activated by the start signal to reformat the signaling data streams inputted from the plurality of framers and output report data in an order of each link; a CPU, interface which interfaces the CPU and  
15 the signaling processing unit; and a common memory (CM) interface, which interfaces  
20 the signaling processing unit; and a common memory (CM) interface, which interfaces

the CAS signaling processing unit with a common memory to provide the report data to the common memory.

To further achieve at least these objects in whole or in parts, there is provided a data processing apparatus for a STM-1 interface block, comprising a plurality of  
5 framers, configured to interface 21 E1 links and extract signaling data streams from the E1 links; a CAS signaling processing unit, which reformats the signaling data streams outputted from the plurality of framers into report data in link order; a common memory (CM) coupled to store the report data outputted from the CAS signaling processing unit; a stream select unit which outputs the inputted signaling data streams in a prescribed order in accordance with a link increase signal outputted from the CAS  
10 signaling processing unit; a signaling processing unit which reads the bit stream outputted from the stream select unit and reformats it into the report format; a CPU coupled to output a start signal to the CAS signaling processing unit to initiate CAS signaling data processing; a CPU interface which interfaces the CPU and the signaling processing unit; and an address generation unit which generates a write address of the CM in a prescribed order in accordance with the address increase signal outputted  
15 from the CAS signaling processing unit.

Additional advantages, objects, and features of the invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from  
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practice of the invention. The objects and advantages of the invention may be realized and attained as particularly pointed out in the appended claims.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described in detail with reference to the following  
5 drawings in which like reference numerals refer to like elements wherein:

Figure 1 is a block diagram illustrating construction of a connection scheme of a related art exchanger.

Figure 2 is a block diagram illustrating a related art E1 interface card of the exchanger of Figure 1..

Figure 3A is a drawing illustrating a signaling data stream format of Figure 2.

Figure 3B is a drawing illustrating a report data format of the signaling data. stream of Figure 3A.

Figure 4 is a block diagram illustrating a second connecting construction of the related art exchanger.

15 Figure 5 is a block diagram illustrating the preferred embodiment of a CAS data processing apparatus of an STM-1 interface block of the present invention.

Figures 6~6N are input-output timing diagrams for illustrating the processing of the signaling data stream of Figure 5.

## DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

A CAS data processing apparatus of an STM-1 interface block according to a preferred embodiment of the present invention is preferably implemented within an E1 processing unit similar to the second connecting construction of the related art exchanger 5 depicted in Figure 4. The CAS data processing apparatus can reduce a load of a CPU and process signaling data in real time by processing the CAS signaling data (hereinafter referred to signaling data) through an additional hardware logic.

Figure 5 depicts the preferred embodiment of the CAS data processing apparatus of the STM-1 interface block of the present invention, it comprises a plurality of framers 200-1 ~ 200-21, a LM (Local Memory) 201, a CPU 202, a CM (Common Memory) 203 and a CAS signaling processing unit 204.

The framers 200-1 ~ 200-21 perform E1 link interface, and abstract the signaling data streams from twenty-one E1 links. The CPU 202 performs general control operations, and outputs a start pulse to the CAS signaling processing unit 204 in the 15 signaling data processing. The LM 201 is a memory which stores the processed data of the CPU 202, and the CM 203 is a memory which temporarily stores report data outputted from the CAS signaling processing unit 204.

The CAS signaling processing unit 204 preferably includes a stream select unit 30 which receives the signaling data stream synchronized with a system clock from the 20 framers 200-1 ~ 200-21, and outputs it in a prescribed bit stream order. A signaling

processing unit 31 is provided to temporarily store a bit stream outputted from the stream select unit 30 and to convert the bit stream into a report format. A CPU interface 32 is provided to interface between the CPU 202 and signaling processing unit 31, and an address generation unit 33 is provided to generate a read address of the CM 203 in accordance with an address increase signal outputted from the signaling processing unit 31.

An operation of the CAS data processing apparatus of the STM-1 interface block of the present invention will now be described with reference to the accompanying drawings.

The framers 200-1 ~ 200-21 abstract the 21 E1 links signaling data, and output that data to the CAS signaling processing unit 204. The CPU 202 outputs the start pulse (Figure 6A) to the CPU interface 32 of the CAS signaling processing unit 204.

The CPU interface 32 having thus received the start pulse indicates that the signaling data is now being processed by outputting a busy signal to the CPU 201, as shown in Figure 6B. The start pulse of the CPU 202 is ignored when the busy signal is generated. The CPU interface also activates the stream select unit 30, the signaling processing unit 31 and the address generation unit 33, as shown in Figure 6C. The stream select unit 30 then receives the 21 signaling data streams synchronized with the system clock signal from each of the framers, and outputs a first link signaling data stream to the signaling processing unit 31.

The signaling processing unit 31 generates a low level CMPE (Common Memory Process Enable signal) every 4 time periods, as shown in Figure 6E. Next, as shown in Figures 6H, 6J, and 6K, a SDRE (Signaling Data Latch Enable signal), a CMCS (Common Memory Chip Select signal), and a CMWE (Common Memory Write Enable signal) are generated by being synchronized with the CMPE signal. Herein, the CMCS and CMWE are operated in a write mode by the CM 203.

Accordingly, when the SDRE is at a low level depicted (Figure 6H), the signaling processing unit 31 reads each channel's (time slot) data from the signaling data stream in accordance with the read pulse signal (MCLK), depicted in Figure 6F. The signaling processing unit 31 temporarily stores the read data on a inner circuit. For example, as depicted in Figure 6G, the signaling processing unit 31 reads and stores the time slot #0 data "0000". The read pulse signal (MCLK) is preferably the system clock signal divided into two, and a cycle of it is same as an interval of one time slot. Thus the read pulse cycles through two times for every time slot.

When 4 channels (time slot) have been read, the signaling processing unit 31 reformats the stored signaling data into the report data form, as shown in Figure 6L and outputs the formatted data to the CM 203. It also outputs an address increase signal to the address generation unit 33. When the CM access is finished in accordance with the address increase signal outputted from the signaling processing unit 31, the address generation unit 33 increases a write address of the CM 203. Accordingly, the report data,

as shown in Figure 6L, outputted from the signaling processing unit 31 is stored in the CM 203 in accordance with the write address outputted from the address generation unit 33.

If the signaling data processing for one link (32 channels) is completed, the signaling processing unit 31 outputs a LNIS (Link Number Increment Signal), as shown in Figure 5 6N, in accordance with a LNIE (Link Number Increment Enable), as shown in Figure 6M, to the stream select unit 30, thereby receiving a second link signaling data stream from the stream select unit 30.

When the processing of the 21 links of signaling data has been completed in the same manner, the CPU interface 32 releases the busy signal, and waits for the next start signal input. At that time, the upper processor 205 accesses the report data stored in the CM 203 and controls the STM-1 interface block. The time required for processing the 21 E1 links is preferably maximum 2.75msec.

In addition, the stream select unit 30 and signaling processing unit 31 can be combined as a CAS signaling processing unit, and the address generation unit 33 can be replaced by the CM interface because it shows same operation and effects. The present invention is capable of applying to a trunk connection board high of a speed-hierarchy such as E3 or T3 for processing large amounts of CAS signaling data, and it shows the same operation and effects.

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The CAS data processing apparatus of the STM-1 interface block of the present invention has many advantages. For example, it is capable of processing efficiently the CAS signaling data in a prescribed time (8msec) even if the number of E1 links increases. Furthermore, the CPU generates only the start signal in the CAS signaling data.

Accordingly the CPU is free to perform other jobs sufficiently.

Moreover, the CAS data processing apparatus of the STM-1 interface block as described herein can reduce the load of the CPU drastically by processing the CAS signaling data through the logic of the separate hard. Accordingly it is possible to construct the system with the low speed CPU, thus the manufacture cost can be reduced.

10 The foregoing embodiments and advantages are merely exemplary and are not to be construed as limiting the present invention. The present teaching can be readily applied to other types of apparatuses. The description of the present invention is intended to be illustrative, and not to limit the scope of the claims. Many alternatives, modifications, and variations will be apparent to those skilled in the art. In the claims, 15 means-plus-function clauses are intended to cover the structures described herein as performing the recited function and not only structural equivalents but also equivalent structures.